

REMARKS

The specification and claim 11 were amended to correct a typographical error. The pressures in MPa (mega Pascals) were inadvertently recited as absolute pressures when they should have been recited as gage pressures. The amendment now correctly recites the MPa gage pressures. No new matter was added.

Claim 22 was amended to correct a typographical error. Support can be found on page 10, lines 5-7 of the specification.

The rejection of claims 1-59 under 35 U.S.C. § 103(a) for being obvious over US 5,171,768 to Prentice et al. (hereafter D1) and remarks associated therewith are respectfully traversed for the following reasons:

The present invention is directed to a novel high temperature polymerization process operating at high pressures for producing a polymer. The process includes conveying hybrid reactor mixtures, which include one or more hybrid reactor monomers and one or more hybrid reactor initiators to one or more hybrid reactors. The hybrid reactors are maintained at effective hybrid polymerization temperatures and sub-reflux polymerization gage pressures to cause polymerization of a portion of the hybrid reactor monomers into the polymer. The process further includes conveying hybrid reactor contents from the hybrid reactors to one or more batch reactors maintained at effective batch polymerization temperatures and reflux polymerization pressures to cause polymerization of the remaining portion of the hybrid reactor monomers into the polymer. By utilizing the hybrid/batch reactor combination, the process of the present invention can be operated under safe working conditions. The process of the present invention also allows control of the polydispersity and molecular weight of the resulting polymers while using low amounts of initiators. As a result, by reducing the amount of unreacted initiators remaining in the resulting polymer products, polymer chain degradation and crosslinking that can occur is reduced.

The Office Action on page 3, citing D1, correctly noted that the process of D1 is carried out in the first reaction zone (first reactor) and second reaction zone (second reactor) and subsequent reactor zone thereafter all operating at constant pressure that can range from 130-210 psig. The Office Action further noted on page 3, citing D1, that the first reaction zone is maintained at

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65°C-85°C and the second reaction zone temperature having higher temperature is maintained at 75°C-93°C.

The Office Action on page 3 also readily admitted that D1 fails to disclose running the first polymerization step under sub-reflux condition and under a reflux condition in the second polymerization stage. However, the Office Action on page 3 then stated that it would be obvious to one of ordinary skill in the art to consider the polymerization conditions under constant pressure and low temperature to be readable on applicants' claimed sub-reflux conditions in the first polymerization stage for producing a partially polymerized latex; and the polymerization conditions under a constant pressure and higher temperature in the second stage would be readable on the applicants' claimed reflux conditions, since these conditions from D1 are readable on applicants' claims 10, 11 and 21. Absent any teaching or suggestion in D1, the applicants respectfully question the foregoing statement.

The teachings in D1 would lead to diametrically opposite conclusions. D1 teaches and the Office Action concurred that all the zones in D1 run at the same elevated pressure that can range from 130-210 psig (D1 at column 5, line 24) and that such a constant pressure is higher than the autogenous (means self-generating or produced from within) pressure of the reaction mixture (D1 at column 6, line 55).

As noted in the current specification at page 9, lines 10-19, hybrid reactor is provided monitoring and controlling devices to control pressure within the hybrid reactor. Since no such monitoring and controlling devices are disclosed in D1, it is not clear why or how the reaction zone would run under sub-reflux conditions, which are defined on page 6, lines 14-16 of the current specification as reactor conditions, such as pressure and temperature at which **no boiling of solvents or monomers present in the polymerization medium occurs**. By contrast, the constant system pressure in D1 is maintained by installing a backpressure regulator on the latex overflow outlet line on **the third reactor** (D1 at column 6, lines 55-58) and **not on the first reactor**, which is patentably distinct from the monitoring and controlling devices used in the current invention.

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Moreover, even if one were to utilize the reaction temperatures and pressures as claimed in the current claims 10, 11 and 21 in D1, generation of sub-reflux conditions may not occur, since, as noted on page 10, lines 15-31 of the current specification, since such conditions would depend upon the types of monomers being polymerized, make up of polymerization medium being used and type of polymerization equipment utilized. No such teachings are disclosed in D1. Thus, it would not be obvious to one of ordinary skill in the art that **sub-reflux conditions** would be generated in the first reactor of D1 by merely using reaction temperatures and pressures claimed in the current claims 10, 11 and 21, absent any teaching or suggestions with regards to the monomers being polymerized, polymerization medium being used and type of polymerization equipment utilized.

The inventors unexpectedly discovered that by lowering the amount of initiators used, one could produce polymers of low molecular weight and low polydispersity having desired polymer properties. When Comparative Example 1 (made under reflux conditions) on page 24 of the specification is compared to Copolymer 1 on page 25 (made under sub-reflux conditions followed by reflux conditions), it can be noted that polymers having substantially similar molecular weight can be produced. However, the amount of initiator used in Copolymer 1 was 1.6% as compared to 3.0% in the Comparative Copolymer 1 (see page 26, lines 16-19 of the specification). Such a process was neither recognized nor would it have been obvious to one of ordinary skill in the art in view of the teachings in D1, which teaches (D1 at column 3, lines 22-41) using conventional chain transfer agents, such as mercaptans to lower molecular weight, which according to the current specification on page 1, lines 21-29 is not desirable. Therefore, it would be obvious to one of ordinary skill in the art that D1 fails to teach or suggest the use sub-reflux/reflux combination.

As noted in D1 at column 5, lines 63, only 3 to 12 percent of the monomers are converted into a polymer in the first reactor zone of D1. By contrast, up to 30 to 99 weight percent of the monomers can be converted into polymers in the current invention (specification at page 16, lines 30-32). Thus, it is clear that reaction conditions and the reactor design in D1 are

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patentably distinct from those in the current invention. Thus, it is not seen why claim 12 would be obvious in view of D1.

Moreover, in claims 3, 4, 5, 6 and 16, the polymerization medium containing organic solvents or polymeric components is also claimed. No such polymerization medium is disclosed or would be obvious from the teachings in D1.

As noted, at column 5, lines 53-59 in D1, the monomers in buffer solution are premixed to pre-emulsify monomers and fed simultaneously to the reactors. There is no suggestion or teaching in D1 of conveying polymerization medium before the hybrid reactor mixtures are conveyed. Thus, it is not seen why claim 7 would be obvious over D1.

There is no suggestion or teaching in D1 of conveying inert gas in vapor space in hybrid or batch reactors. Thus, it is not seen why claims 13, 14 and 23 would be obvious over D1.

As noted at column 5, lines 22 in D1, the continuous stirred tank reactors are only connected in series. Thus, it is not seen why claims 36-59 would be obvious over D1, since none of those combinations are taught or suggested in D1.

The rejection of claims 1-59 under 35 U.S.C. § 103(a) for being obvious over US 5,171,768 to Prentice et al. (hereafter D1) further in view of US Patent 5362,826 to Berge et al. (hereafter D2) and remarks associated therewith are respectfully traversed for the following reasons:

At the outset, it is not clear why one of ordinary skill in the art would combine D1 with D2 absent any teaching or suggestions in either. Moreover, even if one were to combine D1 with D2, it would not occur to one of ordinary skill in the art to arrive at the claims of the present invention.

D2 at column 10, line 68-69 and column 12, lines 1-2 states that in a batch process, the reaction may be run under pressure to avoid monomer reflux and the medium can be viewed as absorbing the heat. The continuous process in Example 4 of D2 at column 14 and batch process in example 5 at columns 5 and 6 of D2 were run with polymerization medium under reflux (column 14, line 43 and column 15, line 14 of D2). As noted earlier from the comparison of Comparative Copolymer 1 versus Copolymer 1 in the current speciation, it is the sub-reflux/reflux combination in the present invention that

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is inventive. No such step is disclosed or even remotely suggested in D2. Thus, it can be readily seen that D2 does not recognize the importance of running the process in two stages such as that currently claimed and absent any teachings or suggestions in D1 or D2, taken alone or in combination, it is not seen why one of ordinary skill in the art would arrive at the presently claimed invention.

The following new claims have been added for the examiner's kind consideration:

Support for claim 60 can be found on page 19, lines 24-27 of the specification.

Support for claim 61 can be found on page 7, line 12 of the specification.

Support for claim 62 can be found on page 10, line 28 of the specification.

Support for claims 63 and 64 can be found in claims 1 and 3 and on page 5, lines 6-15 of the specification.

Should the Examiner wish to discuss any issues involved in this application, the Examiner is respectfully invited to contact the undersigned at the telephone number listed below.

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